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Katarina Juselius
Javier Ordóñez

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Katarina Juselius

University of Copenhagen

Javier Ordóñez[*]

Jaume I University

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Abstract

This paper provides an empirical investigation of the wage, price and unemployment dynamics that have taken place in Spain during the last two decades. The aim of this paper is to shed some light on the impact of the European economic integration process on Spanish labour market and the convergence to a European level of prosperity. We find some important lessons to be learnt from the Spanish experience that should be relevant for the new member states. First, high competitiveness in the tradable sector seems crucial for the real and nominal convergence to be successful, implying that the increase of wages in the tradable sector, and subsequently in the nontradable sector, should not be allowed to exceed the growth in productivity. Second, before fixing the real exchange rate it seems crucial that it is on its sustainable (competitive) purchasing power parity level. A real appreciation, as a result of high growth rates during the catching-up period, is likely to be harmful for real growth and employment.

Classification J.E.L.: C32, E24.

Key words: Balassa-Samuelson effect, noninal and real convergence, unemployment dynamics, purchasing power parity, cointegrated VAR.

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1 Introduction

In this paper we try to shed some light on the effect of the European integration on price, wage, and unemployment dynamics in Spain. Spain is the largest of the four "peripheral" countries that joined the European Union and her experience has been successful in curbing inflation and promoting economic growth and employment. By understanding the historical changes in the macroeconomic mechanisms in Spain during the convergence period, we might be able to better foresee (and hopefully avoid) future problems for the new member states. For this purpose, we will analyse a dynamic interdependent system consisting of consumer and producer prices, wages, productivity, interest rates and exchange rates. In particular we will try to address the following questions:

1. Why were the Spanish unemployment rates so persistently high until the mid-nineties and why did they decrease so remarkably from the mid-nineties onwards?

2. Which were the mechanisms behind the steady decline of the Spanish inflation rate until its final convergence to a sustainable European level?

3. Which were the mechanisms behind the improvement in labour productivity over this period?

Our sample begins in 1983:1, a few years after the EMS regime became effective with 11 member states adopting the ERM exchange rate arrangement. Spain did not become a member in the first round: the Spanish inflation was too high and the economy suffered from various structural imbalances. When our sample starts, the Spanish purchasing power parity (hereafter PPP) was at a much lower level than most of the more prosperous EEC member states. When our sample ends in 2003:3, Spain has achieved a PPP level similar to the other European member states. In this sense the Spanish experience is a clear success story. The question is whether there are useful lessons to be learnt by a historical analysis of the nominal and real convergence that obviously took place over this period. The purpose of this paper is to empirically identify successes and failures and how these influenced the path towards a common European purchasing parity level.

The remainder of the paper is organized as follows. In section 2, we discuss the Balassa-Samuelson effect for the convergence of prices and productivity in Spain. Section 3 provides a graphical analysis of the major key variables and discusses their co-movements. Section 4 discusses a theoretical background for the relations to be tested. Section 5 contains the empirical analysis of the wage, price and unemployment dynamics including an identified long-run cointegration structure and the corresponding adjustment dynamics. Section 6 concludes.

2 The Balassa-Samuelson effect and the nominal and real convergence towards the EU

The fact that real exchange rates of less wealthy economies generally deviate substantially from the ones of the more wealthy economies is often referred to as the Balassa-Samuelson effect (Balassa, 1964, Samuelson, 1964). In short it says that a country's general price level is positively related to the level of per capita income. The rational for this is that productivity in the tradeable sector tends to be higher in richer than in poorer countries, whereas productivity in the nontradable sector is more similar. Wage levels in the tradable sector influence wages in the nontradable sector, so nontradables tend to be more expensive in rich countries. For example, one Dmk converted to pesetas in the eighties bought a lot more in Spain than one Dmk in Germany, reflecting the large wage differences between the two countries.

As discussed by Boeri, et. al. (2001), movements in internal price wedge (the difference between the consumer and the producer price index) is likely to reflect the extent of product market competition. When domestic wages are raising as a result of productivity growth, a high degree of foreign competition is likely to prevent price increases in the tradable sector, whereas not in the nontradable sector. This will generally lead to consumer prices increasing more than producer prices. Therefore, a positive co-movement between labor productivity and the price wedge can be taken as evidence of the Balassa-Samuelson effect.

At the initial state of the European economic integration, intra-European trade was enhanced by the removal of the remaining trade barriers, by financial deregulation and by gradually fixing the exchange rates. Thus, Spain's commitment to move towards the European monetary union in 1986 had clearly a positive impact on its real GDP growth. In particular, the increase of export demand for agricultural products was important in this context. The increased prosperity initiated an adjustment process towards the European productivity level and, gradually, towards a European purchasing power parity level. Improvement in productivity can be seen partly as an improvement of technology, partly as an increase in labour intensity as well as a combination of the two. The effect on employment is, however, likely to be very different in the two cases. On one hand, improved technology will generally lead to increasing demand for labor and thus, to higher real wages and employment. On the other hand, improved labor productivity and higher real wages are likely to increase unemployment (at least temporarily) because of a labour reallocation towards more productive sectors (Caselli and Tenreyro, 2005). Both of these effects can be seen in the data.

Below we will attempt to make the mechanisms behind the successful transition from an outsider to a fully integrated European member state more transparent. This will be based on a careful econometric analysis of the com-

plicated interactions between productivity improvements, real wage growth, inflation and unemployment in the transition period. The subsequent results will demonstrate that one can broadly identify four different regimes describing various aspects of the convergence towards the European level. Some of these were very successful in terms of growth and prosperity, others less so. First, we will briefly discuss the basic characteristics of the four regimes.

The first sub-period, 1983 - 1986, describes the last few years of a long period of serious structural imbalances, characterized by slowdown in productivity growth, high unemployment rates, real wage growth in excess of productivity growth, and high inflation rates. The roots of these problems can be traced back to the oil crisis in the seventies which hit the Spanish economy very severely[1]. This shock increased product prices and decreased labour demand. Downward wage rigidities prevented the necessary real wage adjustment that could have restored the demand for labor. Strong bargaining power by labor unions resulted in wage claims which substantially exceeded productivity growth. The result was stagflation: inflation as well as unemployment increased in this period.[2] Thus, real GDP growth was still modest and unemployment rate was high up to the decision in 1986 to join the EMS.

The second sub-period, 1987 - 1993, describes the early EMS period ending with the crisis in 1992. In most of this period Spain experienced high growth, declining unemployment rates, together with raising real wages and consumer prices, very much in accordance with the Balassa-Samuelson effect. In the first years Spain adopted the broad bands of the Exchange Rate Mechanism ($\pm 6\%$) and from 1989 the narrow bands ($\pm 2.25\%$). Even though productivity continued to increase, there was a sign of a slowdown at the end of the period, possibly indicating that productivity had begun to catch up with the EU level. With high real interest rates, Spain experienced large inflows of foreign capital, and the consequent appreciation of the Spanish peseta eroded competitiveness in the export sector. At the same time, a steady increase of real wages in excess of productivity resulted in a serious loss of competitiveness. Because the membership in the ERM prevented competitive devaluations, the economy got stuck in external and internal imbalances that gradually became unsustainable. This was spotted by the financial market which launched a speculative attack on the Spanish peseta in September 1992 forcing Spain to leave the narrow bands of the ERM and to devalue the peseta.[3]

The third sub-period, 1993-1998, describes the restructuring and consolidation regime starting from the speculative attack in September 1992 and

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[1]In 1977 approximately 66% of the consumed energy was imported.

[2]From 1977 to 1985 Spain experienced a huge employment reduction (about two million jobs) which raised the unemployment rate to 21% of the labour force.

[3]The Spanish currency was first devaluated by 5% in September 1992 and further 6% and 8% in November 1992 and May 1993 respectively. The last devaluation took place in March 1995 by a 7%.

ending with the launch of the Euro in 1999. During the first years, the floating peseta brought the real exchange rate back to its pre-1987 level. The market labour reforms of 1994 and 1997 contributed to reduce labor union´s bargaining power. Excessive wage claims were avoided and competitiveness was restored. From 1996 onwards, almost ten years after the membership in the EU, unemployment rates started to decline more permanently. In 1999, Spain was finally joining EMU as a full member.

The fourth sub-period, 1999-2003, describes the more recent period of full EMU membership during which the Spanish economy seems to have done very well: productivity increased, inflation remained at the EU level, real interest rates came down and economic activity improved.

3 A graphical analysis

To illustrate why we found it useful to divide the full sample period into the four sub-periods, we will present a graphical analysis of the development of wages, prices, productivity and unemployment rate and how they are related to the fluctuations in the real exchange rates and in the long-term interest rate. To better see the co-movements between the variables, we have generally adjusted the graphs to have the same mean and range.

Figure 1(a) illustrates the strong co-movement between productivity (log output divided by log employment) and the internal price wedge (log consumer prices minus log producer prices) consistent with the Balassa-Samuelson effect. This co-movement is particularly dominant in the ERM period 1987-1992. As discussed above shocks to the price wedge are likely to reflect competitiveness in the tradable sector as well as the Balassa-Samuelson effect. The latter is likely to generate a systematic trend in the price wedge, whereas the former is not. In Figure 1(a) we note that the price wedge has grown almost linearly until 1994-95, after which the growth is tapering off. This is taken as an indication that the Balassa-Samuelson effect was very significant until the beginning of third subperiod, but less so after 1995.

Figure 1(b) shows strong counter-cyclical movements between unemployment and trend-adjusted productivity over the whole period. The increase in unemployment in the first pre-ERM regime seems to coincide with a slow-down in productivity growth, whereas the strong growth cycle in the second regime significantly improved employment. The strong recession in the third regime which coincided with the speculative attack on the peseta dramatically increased unemployment. The subsequent recovery implied a steady improvement of employment, with unemployment rates falling to previously record low levels.

Figure 2(a) illustrates the co-movements between real product wages corrected for productivity (the negative of the profit share) and real exchange

rates: In the first period, real exchange rates were essentially fluctuating around a constant level as was profit shares, whereas the second period exhibited a steady appreciation of the peseta mostly due to the strong productivity growth in this period but also to the high levels of the Spanish interest rate. Because real producer wages increased at the same time as the peseta appreciated, profit shares and competitiveness declined. In September 1992 the speculative attack forced the peseta to float and in the next two years it lost roughly 26% of its value.

Figure 2(b) illustrates the development of productivity (corrected for seasonal means) and real producer wages (corrected for seasonal means). The strong growth in real product wages in excess of the growth in productivity is notable in the third regime. As evidenced by Figure 2(a) this coincided with a decline in profit shares. The unsustainable growth in real wages resulted in a strong recession in 1992-1993, followed by a decline in real producer wages in 1994. From 1995 onwards, real product wages and productivity have developed more or less in parallel.

Figure 3(a) illustrates the strong co-movements between real consumption wages and unemployment rate in all four regimes signifying the strong unemployment effects on real consumption wages. Figure 3(b) illustrates the development of unemployment rate compared to the CPI inflation showing that the inflation rate has been steadily declining independent of whether unemployment has been increasing or decreasing. Thus, there does not seem to be a strong Phillips curve effect in this period.

Figure 4(a) shows that unemployment and the long-term bond rate have to some extent been co-moving, but that the relationship is not very clear-cut. Unless we account for the effect of other variables, it will be difficult to show a positive relationship between the two. Figure 4(b) demonstrates that CPI inflation has generally been higher than PPI inflation, with the exception of the first year of the EMU and in the few years after the devaluation of the peseta in 1993, when the rise in import prices seemed to have increased PPI inflation.

Figure 5 presents a scatter graph of productivity against employment. As can be seen the two clear periods of employment reduction (1980 to 1985 and 1990 to 1995) coincided with an important increase in labour productivity.

4 Theoretical background

In what follows we present some broadly defined loglinear economic relations to be subsequently tested. Some of these represent reduced form relations consistent with several theoretical models.[4] Following Layard, Nickell and Jackman

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[4]The discussion in this section is strongly influenced by Chapter 19 in Juselius (2005).

(1991), we consider an open-economy model with price-setting firms and non-competitive wage determination. This framework seems appropriate for the Spanish labor market, where wages to a large extent have been set by collective wage bargaining. A proposed pay rise by the labor union reflects generally a trade-off between a higher consumption wage against a lower employment as a result of an increase in the real product wage (Flanagan *et. al.*, 1993). Whether the pay rise is accepted or not by the employers' organizations is likely to depend on a trade-off between future profits and firm competitiveness against the increased risk of a union strike.

The centralized part of the wage formation is assumed to be a struggle over the mark-ups, where expectations of future outcomes of key variables may play a significant role. We assume that labor unions strive to maximize their share of the productivity increase where productivity is defined as output per employed, $q_t = y_t - l_t$. The employers' unions attempt to maximize the mark-up on unit costs, defined here as the negative of $(w_t - p_{y,t} - q_t)$, at the same time accounting for the anticipated effect of an increase of the real product price on its competitiveness. The mark-up is assumed to be a function of expected inflation, Δp_t^e, expected nominal interests, R_t^e, and the expected real exchange rate, $rer_t^e = (s + p^f - p^d)_t^e$, where s is nominal exchange rate, p^f is the foreign price level, p^d is the domestic price level, i.e.:

$$(w_t - p_{y,t} - q_t) = f(rer_t^e, R_t^e, \Delta p_t^e) + v_{1,t} \qquad (1)$$

where $f_{rer_t^e} > 0$ implies a lower mark-up as a result of a real appreciation (see Phelps, 1994), $f_{R_t^e} > 0$ implies a lower mark-up as a result of a rise in the interest rate, and $f_{\Delta p^e} > 0$ indicates a negative effect on the markup from inflation (see Banerjee and Russell, 2005).

The labor unions attempt to maximize the purchasing power for their members by increasing the real consumer wage, $(w_t - p_{c,t})$ conditional on the level of productivity, q_t, and accounting for the expected effect on the unemployment rate, U_t^e, real exchange rate and inflation rate, i.e.:

$$(w_t - p_{c,t} - q_t) = g(U_t^e, \Delta p_t^e, rer_t^e) + v_{2,t} \qquad (2)$$

where $g_{U^e} < 0$, $g_{\Delta p^e} > 0$ and $g_{rer_t^e} > 0$. Expected values, X_t^e, are not assumed to deviate from the actual values X_t with more than a stationary error.

The bargaining power of the labor unions is assumed to be approximated by a fraction ω, where $0 \leq \omega \leq 1$, so that the outcome of the negotiations can be formulated as a weighted average of the real consumer wage and the real product wage.

An aggregate wage relation for the real product wage can now be formulated as:

$$w_t - p_{y,t} = (1 - \omega)(p_{c,t} - p_{y,t}) + q_t + h(U_t^e, \Delta p_t^e, rer_t^e, R_t^e) + v_{3,t} \qquad (3)$$

or, equivalently, for the real consumption wage:

$$w_t - p_{c,t} = -\omega(p_{c,t} - p_{y,t}) + q_t + h(U_t^e, \Delta p_t^e, rer_t^e, R_t^e) + v_{3,t} \qquad (4)$$

Assuming log linearity and focussing on (4), the hypothetical long-run consumer wage relation becomes:

$$w_t - p_{c,t} = a_1(p_{c,t} - p_{y,t}) + q_t + a_2 U_t + a_3 \Delta p_t + a_4 rer_t + a_5 R_t + a_0 + v_{3,t} \qquad (5)$$

where expected values have been replaced with actual observations, a_1 is an estimate of $(1 - \omega)$, $a_2 \leq 0$, $a_3 \geq 0$, $a_4 \geq 0$, $a_5 \geq 0$, and a_0 is an intercept.

Provided that $v_{3,t}$ is stationary, and that the individual variables are non-stationary, there exists several possible cointegration specifications which can reproduce (5). Because both the wage share of output prices and of consumer prices exhibit typical nonstationary behavior as demonstrated by Figure 6, cointegration analysis can be used to test the hypothetical determinants in (1) and (2). However, the result that profit shares are cointegrated with real exchange rates, say, does not exclude the possibility that the former are affected by the other determinants. This is because some of the relevant determinants can be cointegrated between themselves and, thus, influence real wages through their own regression coefficient. For example, if the seven variables in (5) share two common stochastic trends (as we find), then there would be five irreducible cointegration relations between the variables. With more common stochastic trends there would be correspondingly less cointegration. This implies that we can use cointegration techniques to find out which of the determinants in (1) and (2) are most strongly cointegrated with real product and consumption wages corrected for productivity as well as other relevant relationships in the data as exemplified below.

For example, if U_t and $\Delta p_{c,t}$ share one common stochastic trend then they would be cointegrated :

$$\Delta p_{ct} = a_6 + a_7 U_t + v_{4,t} \qquad (6)$$

where $a_7 \leq 0$ would imply a Phillips curve relation with a constant natural rate[5]. Another possibility is a "demand-for-labor" relation describing unem-

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[5]Note that the Phillips curve is defined here to be a relation between nonstationary

ployment rate as a function of the basic determinants of the demand for labor:

$$U_t = a_8(w_t - p_{c,t}) + a_9 R_t + a_{10} rer_t + a_{11} + v_{5,t} \qquad (7)$$

where $a_8 \geq 0, a_9 \geq 0$, and $a_{10} \geq 0$ would be consistent with a demand for labor interpretation.

Among the variables in (5) we would also expect to find a medium-run relation describing the dynamic adjustment of inflation rate to the level of relative prices. For example, the hypothesis that inflation rate is dynamically adjusting to the domestic and the foreign price wedge and to real wages can be specified as:

$$\Delta p_{c,t} = a_{12} + a_{13}(p_c - p_y)_{t-1} + a_{14} rer_{t-1} + a_{15}(w - p_c)_{t-1} + v_{6,t} \qquad (8)$$

where $a_{13} \leq 0$, $a_{14} \geq 0$, and $a_{15} \geq 0$ implies equilibrium correction given that $v_{7,t} \sim I(0)$.

Different bargaining structures imply different terms of trade between a rise in the real consumption wage and the real product wage (Flanagan *et. al.*, 1993). For example under mark-up pricing, if wages increase in one sector, but not in others, then output price will increase but the impact on the consumer price will be small. Thus, the increase in real consumption wage will be higher than the increase in real product wage.

However, the extent of product market competition is even more important for the price wedge. If an industry is exposed to a high degree of foreign competition, product prices cannot be raised by much even though the domestic wages rise. Assume that a nationwide wage rise hits a highly exposed industry, the output prices of which are already on (or above) the competitive foreign trade level. In this case the industry has the possibility to (1) reduce employment until the marginal cost equals the competitive price, (2) increase labor intensity, or (3) close down the industry. This scenario seems to be very relevant in the investigated sample period, where increased European integration and financial deregulation put a strong pressure on the Spanish competitiveness. Output prices in this period did not fully reflect the increase in wages and competitiveness was achieved by improvement in labor productivity. As Figure 4 illustrates, productivity, rather than the real product wage, seems to have adjusted as a result of a wage increase.

This means that we expect to find a relationship between the internal price wedge and productivity corrected for a trend. However, in a period where the Balassa-Samuelson effect is likely to be dominant, we would expect

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variables. However, given the graphs in Figure 3, it does not seem very likely that the Phillips curve was empirically important in the present period.

the price wedge as well as productivity to be trending upwards. Thus, the positive relationship between productivity and the price wedge is likely to be particularly strong in this case. As demonstrated in Section 3, Figure 1, the time trend in the price wedge is tapering off at around 1995 when the catching-up of productivity is approaching the European level. To account for the "other-than-Balassa-Samuelson" productivity growth we need to allow for a trend in the price wedge-productivity relation:

$$(p_{c,t} - p_{y,t}) = a_{17}q_t + a_{18} + a_{19}t + v_{7,t}, \tag{9}$$

where $a_{17} \geq 0$, $a_{19} \geq 0$.

5 Wage, price and unemployment dynamics in Spain

The purpose of the empirical analysis is to extract as much information from the data as possible at the background of the broadly defined theoretical relations discussed in the previous section. When testing these relations we consider an empirical rejection equally relevant as an empirical acceptance. Failure to find a relationship in the data is considered an important signal that a previously relevant mechanism might have become less important in the transition period. As the economic forces activated by deregulation, abolishment of trade barriers, increased political discipline, are likely to be substantial, we expect the economic mechanisms to be different in the present period as compared to for example the period preceding the EMS. Because of lack of data for the seventies only the EU convergence period is investigated here.

5.1 Defining the empirical model

The quarterly data used in this analysis are defined by:

$$x'_t = [r\omega_t, q_t, u_t, \Delta p_t, pp_t, rer_t, lr_t] \quad \text{t=1983:3 to 2003:3}$$

where $r\omega_t$ is the log of real wage which corresponds to the salary per hour in the manufactured sector deflated by the consumer price index; q_t is the log of labour productivity, calculated as real GDP per total employment; u_t is the unemployment rate; Δp_t is the first difference of the log of the consumer price index and measures inflation; pp_t is the price wedge and corresponds to the difference between consumer price index and producer price index, both expressed in logs; rer_t stands for the log of the real exchange rate of the Spanish

peseta relative to the German mark and is expressed in units of national currency per foreign currency; finally, lr_t is the ten years government bond yield. The long-run interest rate is divided by 400 to make the estimated coefficients comparable with logarithmic quarterly changes.

The empirical analysis is based on the VAR(2) model with a linear trend restricted to the cointegration space:

$$\Delta x_t = \Gamma \Delta x_{t-1} + \alpha \beta' x_{t-1} + \alpha \beta_1 t + \alpha \delta_0 Ds_t + \Phi_1 Dp_t + \Phi_2 Dq_t + \mu_0 + \varepsilon_t \quad (10)$$

where $\mu_0 = \alpha \beta_0 + \alpha_\perp \gamma_0$ is unrestricted, β_0 is an intercept in the cointegration relations and γ_0 measures the slope of linear trends in the data. The coefficient β_1 is the slope of a linear time trend restricted to be in the cointegration space, and δ_0 stands for a mean shift in $\beta' x_t$ as a result of mean shifts in the variables that do not cancel in the cointegrated relations[6]. These shifts are captured by the three dummy variables in $Ds_t = [DS861_t, DS923_t, DS991_t]$, where $DSxxy_t = 1$ for $t \geq 19xx$:y, otherwise 0. In addition, there are five permanent impulse dummies, $Dp_t = [Dp861_t, Dp923_t, Dp991_t, Dp951_t, Dp011_t]$ where $DPxxy$ is 1 in $199xx$:y, 0 otherwise.

The shift dummy $DS861$ accounts for the Spanish entry in the EU, $DS923$ describes the impact of the EMS crisis in September 1992, and $DS991$ accounts for the beginning of the common monetary policy. The first three impulse dummies account for the large shock at the beginning of the three regimes in 1986:1, 1992:3 and 1999:1. The last two account for a change from monetary aggregate targeting to inflation targeting in 1995:1 and a change in the employment survey in 2001:1 which implied a reduction of the official unemployment by around 2.5%.

The baseline model has been carefully checked for signs of misspecification using a variety of diagnostic tests. According to these, the model seem to describe the data reasonably well. No serious deviations from the basic assumptions of residual independence, heteroscedasticity, and normality were detected. But, of course, complete parameter constancy is hard to guarantee in a period of such significant changes in the macroeconomy. In this sense, some of the estimates should be considered average effects over the period in question.

5.2 An identified structure of long-run relations

Following Juselius (2003), we expect at the outset at least two common trends describing permanent shocks to prices and productivity and, therefore, a maximum number of five cointegration relationships. Table 1 reports the Bartlett

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[6]See Juselius (2005) for a discussion of deterministic components in the cointegrated VAR model.

corrected trace test, the roots of the characteristic polynomial and the t-statistic of the adjustment coefficients. All this information seems to be consistent with a rank of five and we continue with this choice.

Table 2 presents the identified structure of cointegration relations. The 10 overidentifying restrictions are accepted with a p-value of 0.77 based on the test statistic $\chi^2(10) = 6.48$. Parameter constancy is checked using the recursive test procedures in Hansen and Johansen (1999). Figure 7 shows the test of constancy of β under forward (panel a) and backward (panel b) recursion and figures 8 to 10 present the constancy tests for the loadings α. According to these tests the cointegration space seems reasonably stable.

The first relation corresponding to (1) describes that real product wages, corrected for productivity, are cointegrated with real exchange rates with a coefficient which is consistent with the Phelps hypothesis discussed in Section 4:

$$ rw_t - q_t + pp_t = \underset{[6.13]}{0.75}\, rer_t + \underset{[6.79]}{0.14}\, Ds861 \underset{[-10.75]}{-0.37}\, Ds923 \underset{[-10.99]}{-0.26}\, Ds991 + \underset{[17.69]}{0.012}\, t. $$

(11)

The three shifts in the equilibrium mean suggest that the level of real wages, corrected for productivity and real exchange rates, increased by 0.15 in the second regime when Spain entered the EU, fell by $0.23 = 0.37 - 0.14$ in the ERM crisis regime and fell additionally by 0.26 in the EMU period.

The second relation corresponding to (2) describes that real consumption wages, corrected for productivity, are cointegrated with unemployment rate as well as with real exchange rates:

$$ rw_t - q_t = \underset{[-13.59]}{-1.24}\, u_t + \underset{[7.01]}{0.47}\, rer_t + \underset{[4.60]}{0.04}\, Ds861 \underset{[-4.70]}{-0.06}\, Ds923 \underset{[-11.22]}{-0.16}\, Ds991 $$

(12)

The negative and highly significant coefficient to unemployment rate indicates that it was the high levels of unemployment rates until 1995 that finally stopped nominal wage claims in excess of productivity growth. The positive coefficient to real exchange rates shows that real consumption wages were compensated to some extent for the loss/increase in purchasing power parity as a result of a devaluation/depreciation of the peseta. Similar to the first cointegration relation, real consumption wages, corrected for productivity, unemployment, and real exchange rate, seemed to increase in the second regime by 0.04, decreased in the next regime by 0.02, and decrease additionally by 0.16 in the EMU regime.

The third relation, corresponding to (9), shows that productivity and the

price wedge corrected for a trend have been cointegrated, signifying the strong Balassa-Samuelson effect in this period:

$$q_t = \underset{[7.60]}{0.31}\, pp_t \underset{[-9.03]}{-0.08}\, Ds923 + \underset{[17.46]}{0.004}\, t \tag{13}$$

The negative coefficient to the shift dummy measures the average drop in the level of real GDP at 1992:3 as a result of the loss of competitiveness that triggered off the ERM crisis. The trend coefficient shows that productivity grew with 1.6% per year in addition to the Balassa-Samuelson catching-up growth.

The forth relation corresponding to (8), shows that inflation rate has dynamically adjusted to the internal and external price wedge:

$$\Delta p_t = \underset{[-9.18]}{-0.04}\, pp_t \underset{[-3.91]}{-0.02}\, rer_t \tag{14}$$

Thus, the development in external and internal competitiveness seems to explain the decline in inflation rate over this period. The absence of a real wage effect in (14) suggests that wage pressure (cost-push) has not been important for inflation in this period. This again suggest pricing-to-market, rather than mark-up-pricing, as the dominant price-setting mechanism. Given a very competitive product market, excessive wage claims are likely to lead to adjustment in labor productivity (and labor lay-offs) rather than adjustment in prices. This is likely to explain why inflation rate has been steadily decreasing, even though real wages have increased more than productivity in this period. This interpretation is strongly supported by the last relation which corresponds to the demand for labor relation in (7):

$$u_t = \underset{[10.67]}{0.75}\, rw_t + \underset{[10.38]}{0.42}\, rer_t + \underset{[12.16]}{4.0}\, lr_{tt} \underset{[-7.19]}{-0.08}\, Ds923 \underset{[-10.84]}{-0.08}\, Ds991 \tag{15}$$

It shows that unemployment rate has increased with real consumption wages, has increased when the exchange rate has depreciated, and has increased with the long-term interest rate. The shift dummies shows that unemployment came down significantly as a result of the restoration of competitiveness after September 1992, and after joining the EMU in 1999. Thus, the results suggest a strong trade-off between unemployment and real wage increases in excess of productivity growth.

Finally, the empirical testing did not support a Phillips-curve relationship between inflation rate and unemployment rate. This is further evidence of the decreasing importance of cost-push pressure of wage inflation on price inflation

and the increasing importance of the real wage - unemployment trade-off.

5.3   The dynamics of the short-run adjustment behavior

Table 3 presents a parsimonious representation of the short-run dynamic adjustment structure in which insignificant coefficients have been set to zero. The test of the 67 overidentifying zero restrictions was accepted based on $\chi^2(67) = 78.72$ and a p-value of 0.15. Since the dynamic adjustments to the long-run relations is particularly interesting, we will focus on this aspect when commenting on the estimated results.

The real consumption wages are significantly overshooting in terms of the real producer mark-up relation ($ecm1$), whereas they are strongly equilibrium correcting to the real consumer wage relation ($ecm2$). These are interesting results suggesting that labor unions have been able to achieve excessive real wage increases, but at the price of a subsequent increase in unemployment rate that brought the level of real consumption wages back to steady-state. The strong positive effect of $ecm1$ in the unemployment rate equation gives further support to this interpretation. Real product wages are equilibrium correcting to $ecm5$, and are negatively affected by $ecm3$, the Balassa-Samuelson relation.

The productivity is equilibrium correcting to the Balassa-Samuelson relation ($ecm3$) and is positively affected by ($ecm4$). The latter suggests that productivity has improved when consumer price inflation has been above its steady-state value. This seems to be a consequence of the strong product market competition in this period (cf. discussion at page 9).

The unemployment rate has increased when real product wages are above their steady-state value ($ecm1$) and has been equilibrium correcting to the real consumer wage relation ($ecm2$). Unemployment rate has decreased in periods when productivity has been above its steady-state value ($ecm3$), and it has been equilibrium correcting to $ecm5$.

The inflation rate has been equilibrium correcting to the internal and external price wedge ($ecm4$). It is notable that inflation rate has is not been affected by real wages in excess of productivity. This is still another indication of the price pressure due to the increased competitiveness in the product market. It gives further support to the interpretation that the cost-push inflation of the seventies has been replaced by pricing-to-market with adjustment in unemployment and productivity rather than adjustment in inflation.

The internal price wedge has been equilibrium correcting to the Balssa-Samuelsson relation and, in addition, been negatively affected by real product wages being above their steady-state value.

The real exchange rate has been equilibrium correcting both to $ecm4$, describing the inflation rate adjustment mechanism, and to $ecm5$ describing demand pressure in the labor market.

The government bond rate has declined as a result of productivity increasing

more than the internal price wedge, probably describing the general decline in European interest rates as a result of the nominal and real convergence in Europe. The negative effect on the bond rate from an improvement of real consumption wages relative to its steady-state value ($ecm2$) is probably also related to the general convergence. It is equilibrium correcting to $ecm5$, suggesting a fairly strong and highly significant effect from unemployment in excess of its steady-state value. The latter is likely to reflect the fact that the financing of high unemployment rates by issuing government bonds will generally increase the bond rate.

6 Conclusions

Based on a cointegrated VAR analysis this paper has investigated the wage, price, and unemployment dynamics in Spain during the period 1983:3 to 2003:3, a period which approximately coincides with the Spanish convergence process towards the European level of inflation rates, interest rates, and purchasing power parity. The following findings can be emphasized as being particularly important for the three overriding questions in the introduction:

1. Real wages claims in excess of productivity growth seem to have resulted in increased unemployment rather than in price inflation.

2. Only very weak evidence of a Phillips-curve relationship could be found in the data.

3. The real exchange rate (i.e. the competitiveness in the tradable sector) seems to have played a dominant role for the Spanish wage determination through its impact on the mark-up and has strongly influenced the level of the affordable product wage and the acceptable consumption wage.

4. Productivity and the internal price wedge has moved closely together over the sample period, signifying the importance of the Balassa-Samuelson effect.

5. Unemployment rates have significantly come down at the end of the period as a result of real wage restraints, of a competitive level of real exchange rates, and a low level of interest rate.

6. Consumer price inflation has adjusted to the internal and external price wedge in an equilibrium correcting manner. At the end of the period this adjustment process has brought the Spanish inflation rate in line with the European level.

We think the results contain important lessons to be learnt for the new EU member states. First of all, it seems crucial to maintain high competitiveness

in the tradable sector in order to achieve a successful convergence towards the European purchasing power parity level. The increase in consumption wages and consumer prices as a result of the Balassa-Samuelson effect should not be allowed to exceed the improvement in productivity. Second, before fixing the real exchange rate it seems crucial that it is on its sustainable (competitive) purchasing power parity level. Third, there does not seem to be a short-cut to a European level of standard of living: the path to sustainable prosperity seems to follow the path of productivity improvement. Forth, excessive real wage increases seem to lead to increasing unemployment, slowdown in productivity growth, higher interest rates, and loss of competitiveness. On the other hand, the access to the European market and the possibility of increased export demand is likely to speed up the convergence process as long as competitiveness is not eroded by excess wage increases.

References

Balassa, B. (1964): "The purchasing-power parity doctrine: A reappraisal", *Journal of Political Economy*, vol. 72, no. 6, pp. 584–596.

Banerjee, A. and B. Russell (2005): "Inflation and measures of the markup", *Journal of Macroeconomics*, vol. 27, pp. 289–306.

Boeri, T., A. Brugiavini and L. Calmfors (2001): *The Role of Unions in the Twenty-First Century*, Oxford University Press, Oxford.

Caselli, F. and S. Tenreyro (2005): "Is Poland the next Spain?", CEP Discussion Paper No 668, Centre for Economic Performance, London School of Economics.

Flanagan, R., K.O. Moene and M. Wallerstein (1993): *Trade Union Behaviour, Pay-Bargaining, and Economic Performance*, Clarendon Press, Oxford.

Hansen, H. and S. Johansen (1999): "Some test for parameter constancy in cointegrated VAR-models", *The Econometrics Journal*, vol. 2, no. 2.

Juselius, K. (2003): "Wage, price, and unemployment dynamics and the convergence to purchasing power parity in the Euro area", Working Paper 0301, Institute of Economics, University of Copenhagen.

Juselius, K. (2005): *The cointegrated VAR model: Econometric methodology and macroeconomics applications*, mimeo.

Layard, R., S. Nickell and R. Jackman (1991): *Unemployment. Macroeconomic Performance and the labour market*, Oxford University Press.

Phelps, E. S. (1994): *Structural Slumps: The Modern Equilibrium Theory of Unemployment, Interest, and Assets*, Harvard University Press.

Samuelson, P. (1964): "Theoretical notes on trade problems", *Review of Economics and Statistics*, vol. 46, no. 2, pp. 145–154.

Table 1: The cointegration rank

Modulus of the 6 largest characteristic roots

$r = 4$	1.00	1.00	1.00	0.82	0.81	0.68
$r = 5$	1.00	1.00	0.87	0.83	0.80	0.68
$r = 6$	1.00	0.87	0.83	0.82	0.67	0.55

Adjustment coeficientes (*t-ratios*)

	rw	q	u	Δp	pp	rer	lr
$\hat{\alpha}_4$	0.31	-0.63	-1.46	**5.26**	**5.30**	-1.56	**-2.02**
$\hat{\alpha}_5$	-0.62	**-6.46**	1.81	-1.18	-0.91	-0.64	-1.72
$\hat{\alpha}_6$	1.87	0.77	-1.64	-0.29	**-3.88**	**-3.47**	-0.99

Trace test

$p - r$	r	Eig.Value	Trace	Trace*	Cval95	Cval95*
7	0	0.78	390.71	329.74	150.35	
6	1	0.64	271.86	232.11	117.45	157.98
5	2	0.54	190.28	161.10	88.55	123.59
4	3	0.45	128.48	107.70	63.66	92.37
3	4	0.37	80.91	68.33	42.77	65.18
2	5	0.29	44.94	37.10	25.73	44.95
1	6	0.20	17.41	15.43	12.45	21.34

Probability in brackets. Bold face indicates $|t-ratio| > 2$. $Trace^*$ stands for the Barlett corrections to the standard Trace test for the I1-model. $Cval95$ is the critical values corresponding to a model without dummies. $Cval95^*$ is the simulated critical values at 5% for the I1-model with shift dummies.

Table 2: The long-run structure

	rw	q	u	Δp	pp	rer	lr	Ds861	Ds923	Ds991	trend
$\hat{\beta}_1$	1.00 [NA]	−1.00 [NA]	-	-	1.00 [NA]	−0.75 [−6.12]	-	−0.14 [−6.79]	0.37 [10.75]	0.26 [11.00]	−0.012 [−17.69]
$\hat{\beta}_2$	1.00 [NA]	−1.00 [NA]	1.23 [13.59]	-	-	−0.47 [−7.00]	-	−0.04 [−4.60]	0.06 [4.71]	0.16 [11.22]	-
$\hat{\beta}_3$	-	1.00 [NA]	-	-	−0.31 [−7.60]	-	-	-	0.08 [9.03]	-	−0.004 [−17.46]
$\hat{\beta}_4$	-	-	-	1.00 [NA]	0.04 [9.18]	0.02 [3.91]	-	-	-	-	-
$\hat{\beta}_5$	−0.75 [−10.67]	-	1.00 [NA]	-	-	−0.42 [−10.38]	−3.96 [−12.16]	-	0.08 [7.19]	0.08 [10.84]	-

t-values in brackets. LR-test for the restricted model: $\chi^2(10) = 6.48$ with p-value 0.77.

Table 3: The short-run structure

	Δrw_t	Δq_t	Δu_t	$\Delta^2 p_t$	Δpp_t	Δrer_t	Δlr_t
Δrw_{t-1}	0.35 [4.22]	-	-	-	0.09 [3.79]	−0.22 [−2.19]	0.03 [3.06]
Δq_{t-1}	-	−0.32 [−3.63]	-	0.13 [4.78]	-	-	0.04 [3.53]
Δu_{t-1}	-	−1.10 [−4.80]	0.21 [3.69]	-	-	-	-
$\Delta^2 p_{t-1}$	-	0.31 [2.10]	-		−0.28 [−3.96]	-	0.06 [2.71]
Δpp_{t-1}	−0.78 [−3.86]		0.13 [3.82]	−0.24 [−3.75]	0.22 [2.85]	1.20 [4.31]	−0.05 [−2.15]
Δrer_{t-1}	-	-	-	-	-	-	-
Δlr_{t-1}	-	-	−0.51 [−3.20]	-	−0.57 [−2.04]	-	0.55 [6.83]
$ecm1_{t-1}$	0.25 [6.26]	0.05 [2.73]	0.06 [10.6]	-	−0.04 [−6.68]	0.10 [3.53]	0.01 [2.31]
$ecm2_{t-1}$	−1.11 [−9.26]	-	−0.10 [−6.66]	-	-	-	−0.06 [−4.57]
$ecm3_{t-1}$	−0.86 [−6.48]	−0.51 [−5.17]	-	-	0.19 [5.64]	-	−0.08 [−4.25]
$ecm4_{t-1}$	-	-	-	−0.87 [−10.5]	-	−1.09 [−2.73]	-
$ecm5_{t-1}$	−2.93 [−9.01]	0.66 [2.93]	0.26 [4.53]	-	-	−0.76 [−2.07]	−0.26 [−7.13]
$Constant$	2.66 [4.39]	−3.16 [−5.67]	-	0.10 [10.5]	1.05 [6.21]	-	-
$DDS861_t$	0.06 [4.69]	-	-	0.01 [3.42]	0.04 [8.61]	-	-
$DDS923_t$	-	-	0.01 [2.85]	-	-	0.10 [5.64]	0.01 [2.51]
$DDS991_t$	-	-	−0.01 [−4.66]	-	-	-	-
$DP011_t$	-	0.05 [4.26]	−0.02 [−8.81]	-	0.01 [3.15]	-	-
$DP951_t$	-	-	-	-	-	0.10 [6.18]	-

where

$ecm1 = rw_t - q_t + pp_t - 0.75\,rer_t - 0.15\,Ds861 + 0.37\,Ds923 + 0.31\,Ds991 - 0.012\,t$
$ecm2 = rw_t - q_t + 1.16\,u_t - 0.47\,rer_t - 0.05\,Ds861 + 0.07\,Ds923 + 0.18\,Ds991$
$ecm3 = q_t - 0.004\,t - 0.31\,pp_t + 0.07\,Ds923$
$ecm4 = \Delta p_t + 0.03\,pp_t + 0.02\,rer_t$
$ecm5 = u_t - 0.75\,rw_t - 0.42\,rer_t - 3.96\,lr_t + 0.08\,Ds923 + 0.08\,Ds991$

t-values in brackets.

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Figure 1: Productivity, unemployment and the internal price wedge
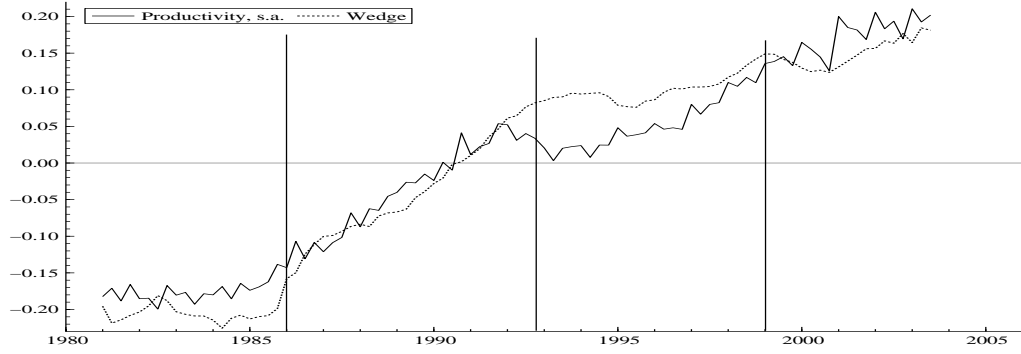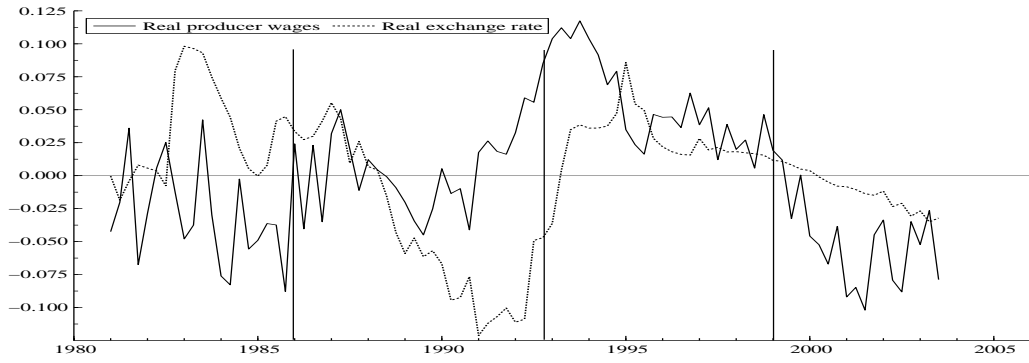

(a) Productivity, s.a. and the internal price wedge

(b) Trend-adjusted productivity and unemployment

Figure 2: Real producer wages, real exchange rates and productivity
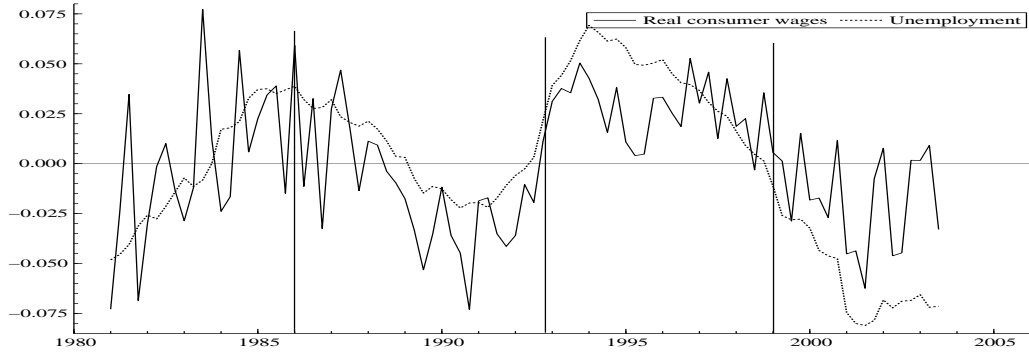

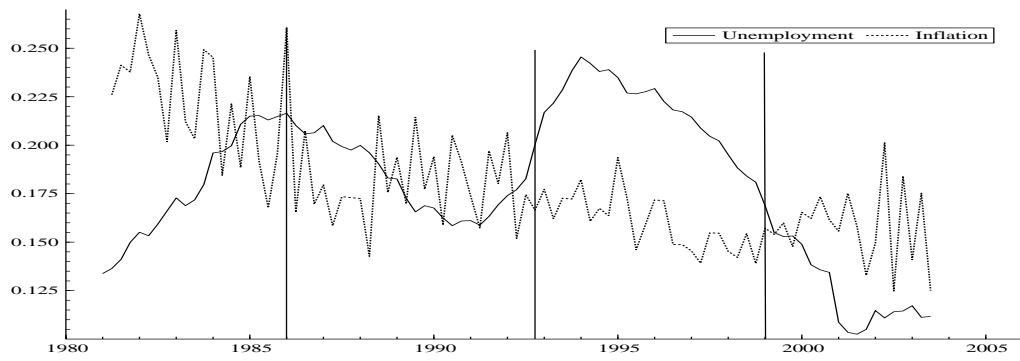(a) Real producer wages corrected for productivity and real exchange rates

(b) Productivity, s.a. and real producer wages

Figure 3: Real consumer wages, unemployment and inflation
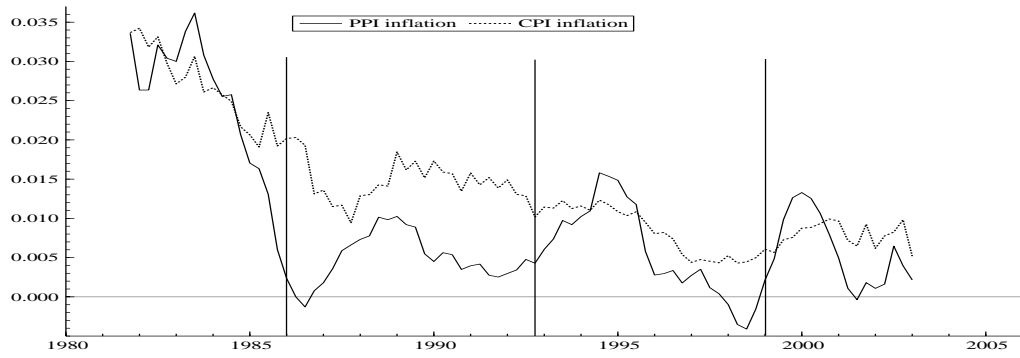

(a) Real consumer wages corrected for productivity and unemployment

(b) Unemployment and inflation

Figure 4: Unemployment, the long-term bond rate and inflation

(a) Unemployment and the long-term bond rate

(b) CPI inflation and PPI inflation

Figure 5: Productivity, employment and real GDP
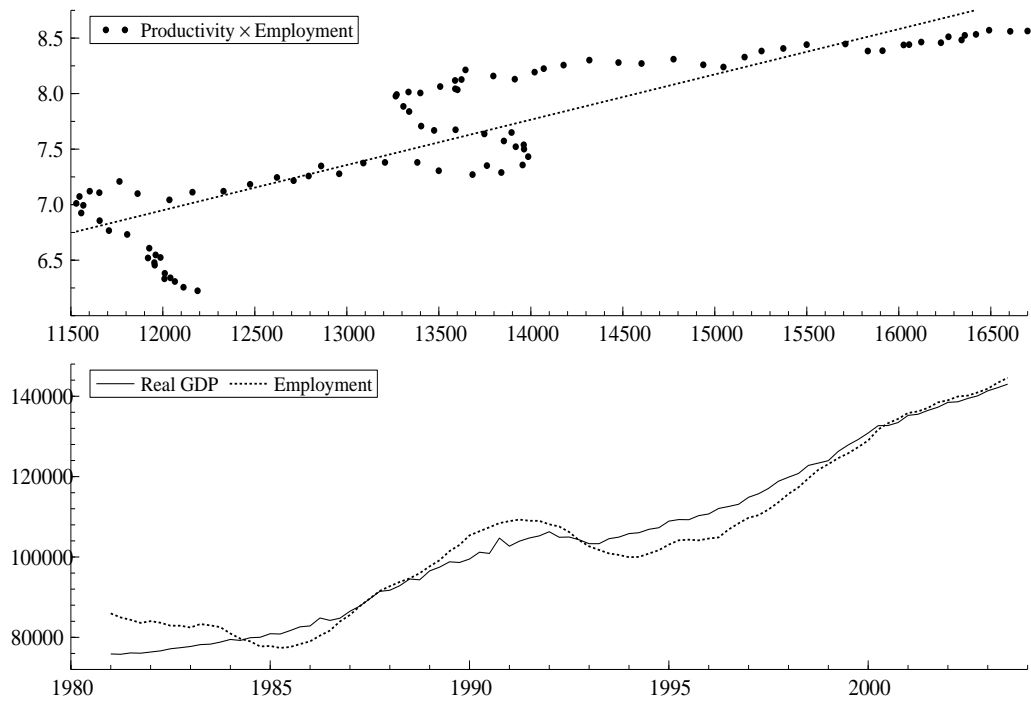
Figure 6: Wage share of output prices and of consumer prices
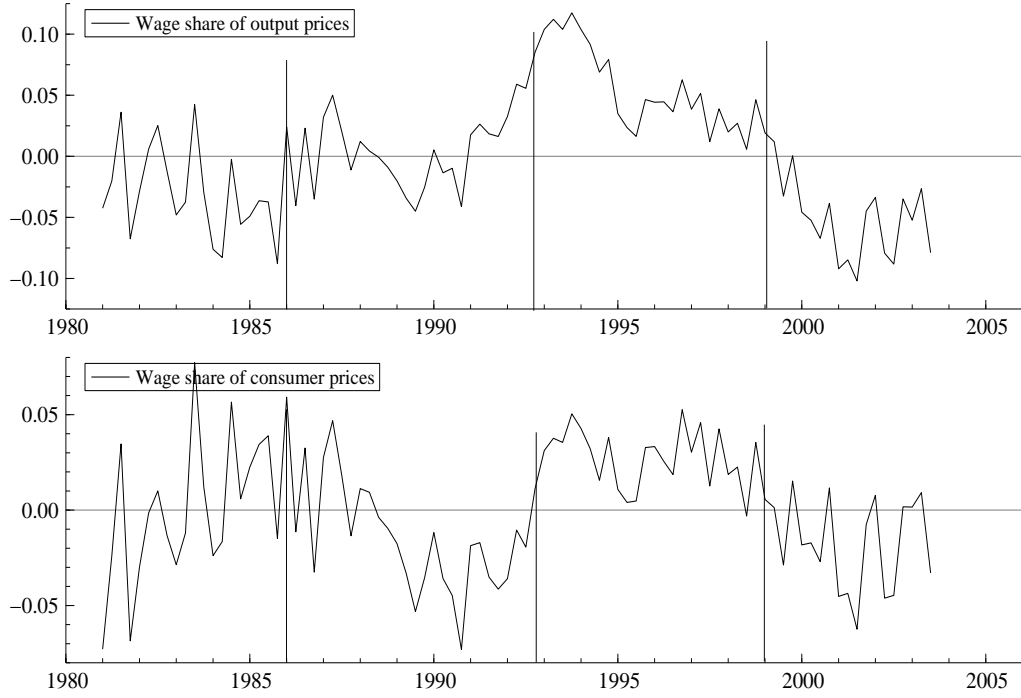
Figure 7: Recursively calculated test statistic for constant β
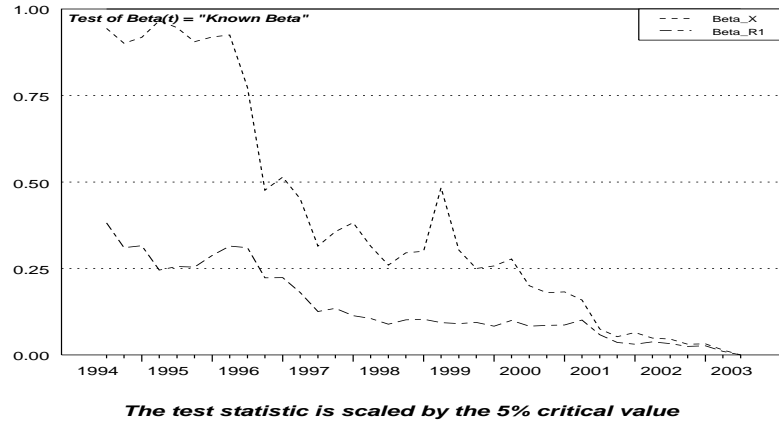
(a) Forward estimation

(b) Backward estimation

Figure 8: Stability of the loadings α (I)
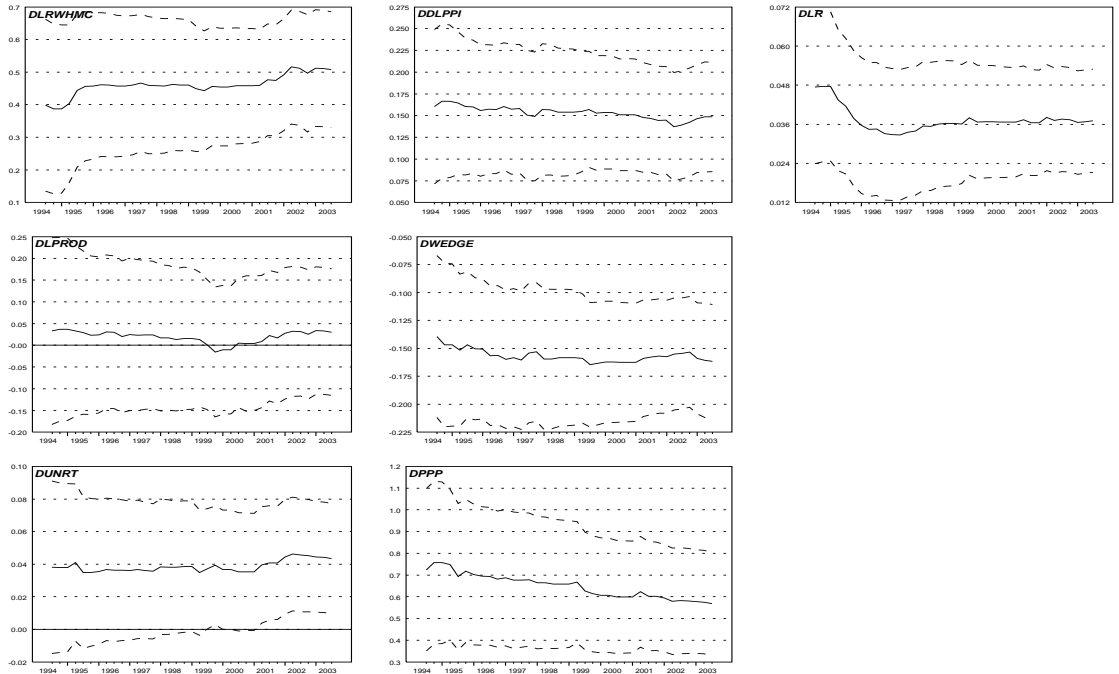
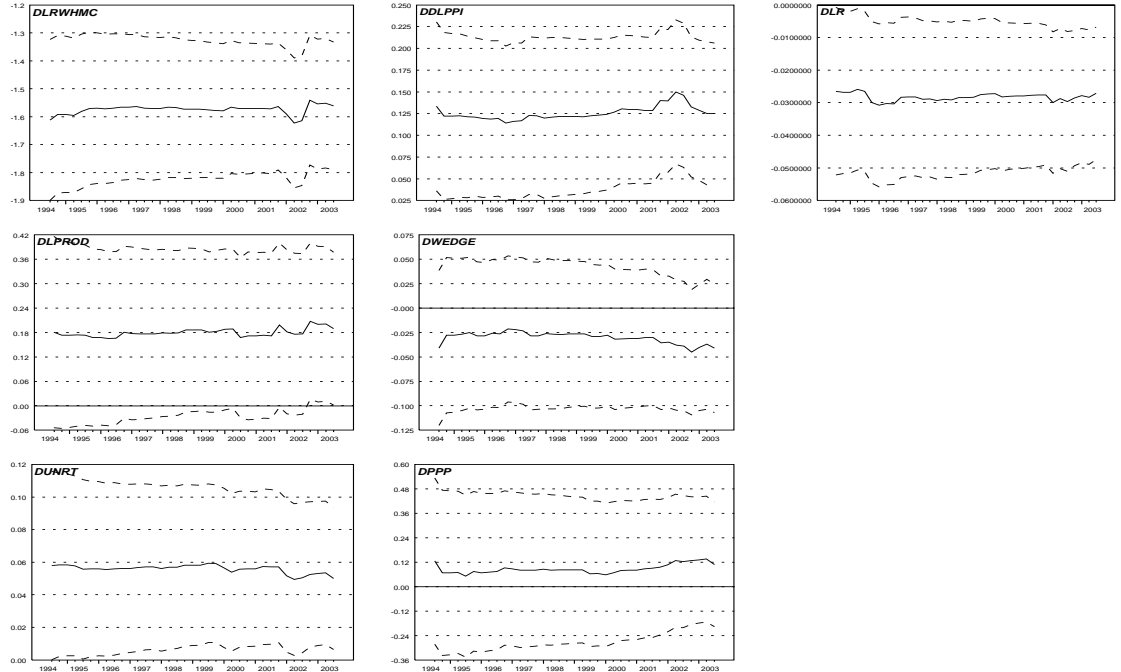*Alpha estimated with Beta fixed at full-sample estimate*

(a) α_1
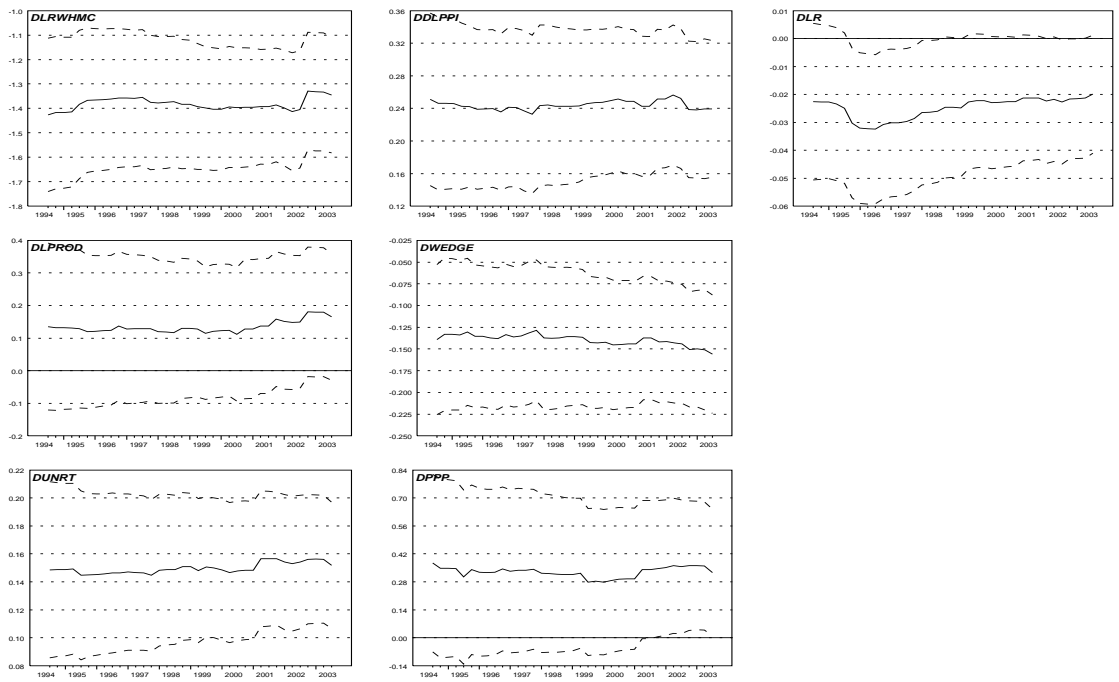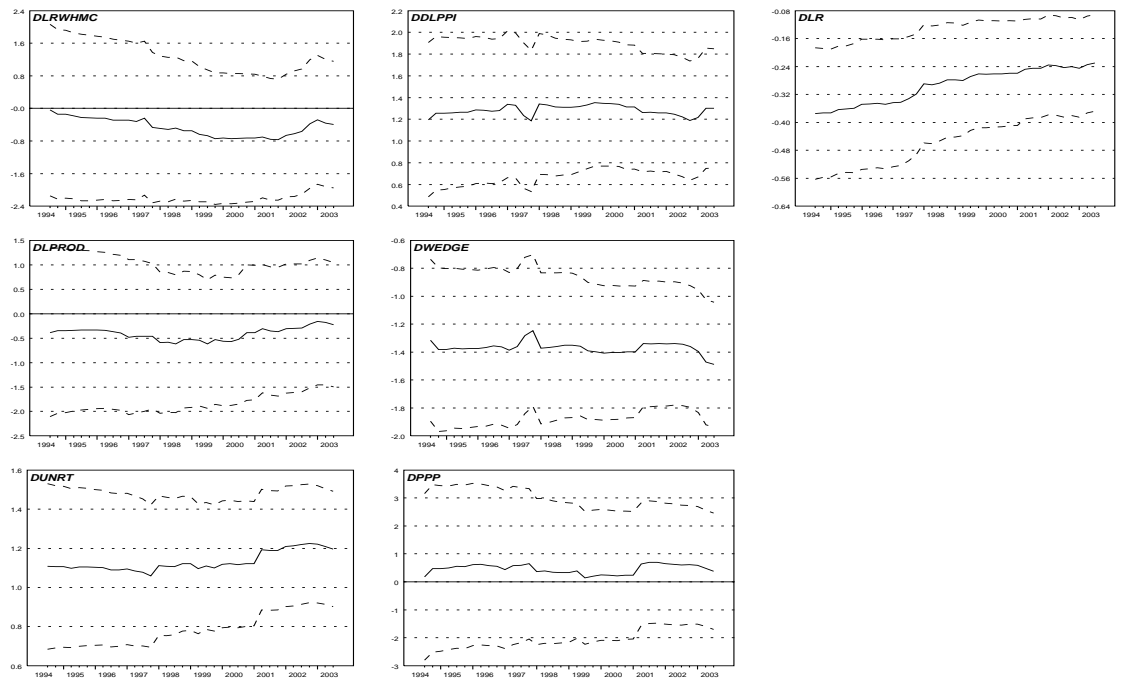

Alpha estimated with Beta fixed at full-sample estimate

(b) α_2

Figure 9: Stability of the loadings α (II)

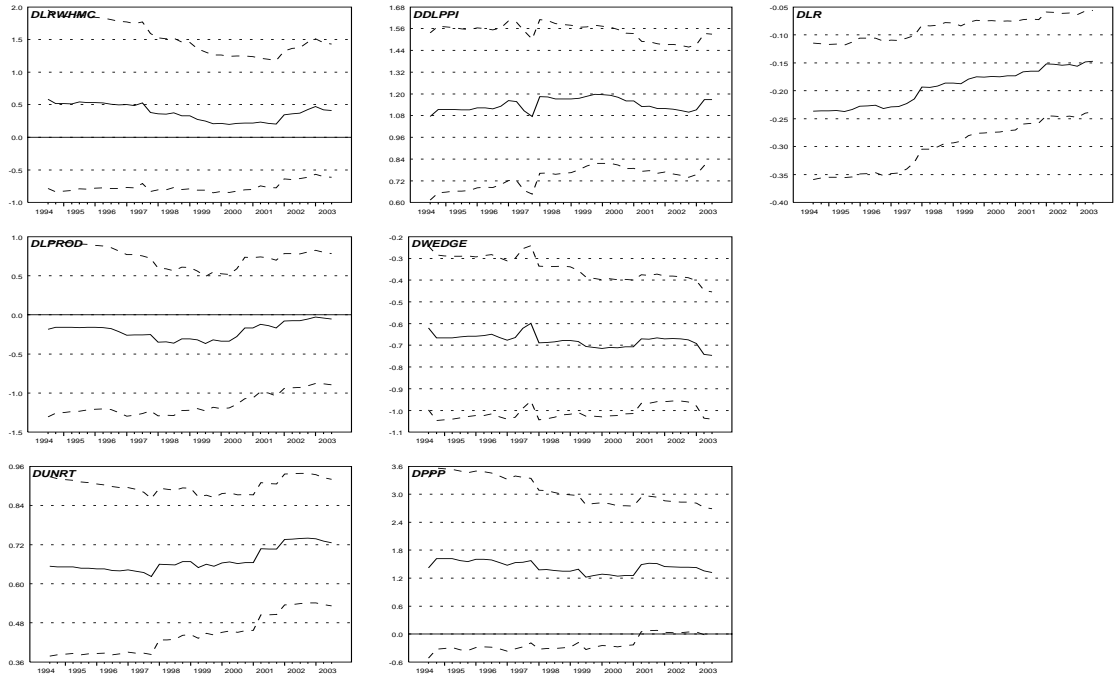*Alpha estimated with Beta fixed at full-sample estimate*

(a) α_3

Alpha estimated with Beta fixed at full-sample estimate

(b) α_4

Figure 10: Stability of the loadings α (and III)

Alpha estimated with Beta fixed at full-sample estimate

(a) α_5